Typhoid Fever

(Also known as Enteric Fever)

Note: This chapter focuses on typhoid fever (caused by *Salmonella typhi)*. For information about non-typhoid salmonellosis, refer to the chapter entitled "Salmonellosis (Non-Typhoid)."

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Typhoid fever is a systemic bacterial disease caused primarily by *Salmonella typhi* (not to be confused with *Salmonella typhimurium*).

B. Clinical Description

Typhoid fever has a different presentation than common salmonellosis. Initial symptoms typically include sustained fever, anorexia, lethargy, malaise, dull continuous headache and non-productive cough. Vomiting and diarrhea are typically absent, but constipation is frequently reported. During the second week of illness, there is often a protracted fever and mental dullness, which is how the disease got the name "typhoid," which means "stupor-like." After the first week or so, many cases develop a maculopapular rash on the trunk and upper abdomen. Other symptoms can include intestinal bleeding, slight deafness and parotitis. Mild and atypical infections are common, but as many as 10–20% of untreated infections may be fatal (the case-fatality rate is <1% with prompt antibiotic treatment). Relapses are not uncommon. Paratyphoid fever is a similar illness but is usually much milder and is caused by the organism *Salmonella paratyphi*.

C. Reservoirs

Humans are the reservoir for *S. typhi* and *S. paratyphi*. Domestic animals may harbor *S. paratyphi,* but this is rare. Chronic carriers are the most important reservoirs for *S. typhi*. About 2–5% of cases become chronic carriers, some after symptomatic infection.

D. Modes of Transmission

S. typhi is transmitted via the fecal-oral route, either directly from person-to-person or by ingestion of food or water contaminated with feces or urine. Shellfish harvested from sewage-contaminated water are potential vehicles, as are fruits and vegetables grown in soil fertilized with human waste in developing countries. Transmission can also occur person-to-person through certain types of sexual contact (*e.g.*, oral-anal contact).

E. Incubation Period

The incubation for typhoid fever ranges from 3 days to 2 months (depending on the infecting dose), with a usual range of 1–2 weeks. For paratyphoid fever, the incubation is usually 1–10 days.

F. Period of Communicability or Infectious Period

The disease is communicable for as long as the infected person excretes *S. typhi* or *S. paratyphi* in the feces or urine. This usually begins about a week after onset of illness and continues through convalescence and for a variable period thereafter. If a carrier state develops, excretion could be permanent.

G. Epidemiology

The annual incidence of typhoid fever worldwide is approximately 17 million cases, with an estimated 600,000 deaths. In the United States, less than 500 cases occur each year, and 70% of these are acquired while traveling internationally. Over the past 10 years, travelers to Asia, Africa and Latin America have been especially at risk. Antimicrobial-resistant strains are becoming increasingly prevalent. Outbreaks have occurred in the United States from food that had been brought here from other countries. Despite suggestions to the contrary, outbreaks do not occur as a result of floods or other disasters in countries that are not endemic for typhoid, such as the United States.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- Isolation of *S. typhi* from blood, stool or other clinical specimen.

Note: For *S. paratyphi* and other *Salmonella* species, see the chapter entitled "Salmonellosis (Non-Typhoidal)." See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

The Massachusetts State Laboratory Institute (SLI), Enteric Laboratory will test stool specimens for the presence of *S. typhi* and will confirm and serotype isolates obtained from other laboratories. For more information on submitting samples, contact the Enteric Laboratory at (617) 983-6609. Additionally, the SLI, Food Microbiology Laboratory (617- 983-6616) will test implicated food items from a cluster or outbreak. See Section 4) D, Environmental Measures, for more information.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify whether the case may be a source of infection for other persons (*e.g.,* a diapered child, daycare attendee or foodhandler) and if so, to prevent further transmission.
- To identify sources of public health concern (*e.g.,* a commercially distributed food product) and to stop transmission from such a source.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the lists of reportable diseases (at the end of this manual's Introduction) for specific information.

C. Local Board of Health Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of *S. typhi* (typhoid fever), as defined by the reporting criteria in Section 2) A above. Current requirements are that cases be reported to the MDPH Division of Epidemiology and Immunization, Surveillance Program using an official MDPH *Bacterial and Parasitic Gastroenteritis Case Report Form* and a CDC *Typhoid Fever Surveillance Report* form (in Appendix A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. **Case Investigation**

   a. It is the LBOH responsibility to complete a *Bacterial and Parasitic Gastroenteritis Case Report Form* (in Appendix A) by interviewing the case and others who may be able to provide information. Much of the information required on the form can be obtained from the case's healthcare provider or medical record.

   b. Use the following guidelines to assist in completing the case report form:
      1) Accurately record the demographic information, date of symptom onset, symptoms, and medical information.
      2) When asking about exposure history (food, travel, activities, etc.), use the incubation period for *Salmonella typhi* (1–3 weeks). Specifically, focus on the period beginning a minimum of 1 week prior to the case's onset date back to no more than 3 weeks before onset.
      3) If possible, record any restaurants at which the case ate, including food item(s) and date consumed. If you suspect that the case became infected through food, use of the MDPH *Foodborne Illness Complaint Worksheet* (in Appendix A) will facilitate recording additional information. It is requested that LBOHs fax or mail this worksheet to the MDPH Division of Food and Drugs (see top of worksheet for fax number and address). This information is entered into a database to help link other

complaints from neighboring towns, thus helping to identify foodborne illness outbreaks. *This worksheet does not replace the Bacterial and Parasitic Gastroenteritis Case Report Form.*

4) Ask questions about travel history and outdoor activities to help identify where the case became infected.
5) Ask questions about water supply; *S. typhi* may be acquired through water consumption.
6) Household/close contact, pet or other animal contact, daycare, and foodhandler questions are designed to examine the case's risk of having acquired the illness from, or potential for transmitting it to, these contacts. Determine whether the case attends or works at a daycare facility and/or is a foodhandler.
7) If you have made several attempts to obtain case information, but have been unsuccessful (*e.g.,* the case or healthcare provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the case report form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely.

c. Complete an official CDC *Typhoid Fever Surveillance Report* form (in Appendix A). The Surveillance Program will forward this form to the CDC. While much of its content is similar to that on the *Bacterial and Parasitic Gastroenteritis Case Report Form* (and can thus be copied directly), please pay special attention to questions regarding antibiotic resistance, typhoid vaccination, and travel history. Additionally, please include a full name and address for the case. There is extra room under the Comments sections at the bottom of the page.

d. After completing the MDPH case report form and the CDC *Typhoid Fever Surveillance Report* form, attach lab report(s) and mail (in an envelope marked "Confidential") to:
MDPH, Division of Epidemiology and Immunization
Surveillance Program, Room 241
305 South Street
Jamaica Plain, MA 02130

e. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

Foodhandlers with *S. typhi* must be excluded from work. For foodhandlers with *S. paratyphi* or other *Salmonella* species, please refer to Section 4A of the chapter entitled "Salmonella (Non-Typhoidal)."

Minimum Period of Isolation of Patient

Foodhandling facility employees may only return to work after producing 3 consecutive negative stool specimens each taken no less than 48 hours apart. If the case has been treated with an antimicrobial, the first stool specimen shall not be submitted until as least 48 hours after cessation of therapy.

Minimum Period of Quarantine of Contacts

All foodhandling facility employees, symptomatic or asymptomatic, who are contacts of a typhoid case shall be considered the same as a case and handled in the same fashion.

Note: A foodhandler is any person directly preparing or handling food. This can include a patient care or child care provider. See glossary for a more complete definition.

B. Protection of Contacts of a Case

Members of households of known carriers are candidates for immunization and should check with their healthcare providers for vaccine options.

C. Managing Special Situations

Daycare

Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up on cases of typhoid fever in a daycare setting. The MDPH *Health and Safety in Child Care* provides detailed information on case follow-up and control in a daycare setting. General recommendations include:

- Children or staff members in a daycare center who test positive for *S. typhi* should be excluded until 3 consecutive stool cultures taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy) are negative. In addition, stool specimens from all staff and attendees should be tested and all infected individuals excluded as well.

- Refer to Chapter 17 of the MDPH *Health and Safety in Child Care* for complete guidelines in handing diseases spread through the intestinal tract.

School

Since typhoid fever may be transmitted person-to-person through fecal-oral transmission, it is important to carefully follow up on cases of typhoid fever in a school setting. The MDPH *Comprehensive School Health Manual* provides detailed information on case follow-up and control in a school setting. General recommendations include:

- Students or staff with *S. typhi* who are experiencing symptoms, such as diarrhea, fever and abdominal pain should be excluded until symptoms are gone.

- Students or staff with *S. typhi* who do not handle food, have no symptoms and are not otherwise ill, may remain in school if special precautions are taken. If a case of *S. typhi* occurs in a kindergarten, 1st grade or a preschool class (where hygiene may not be optimal), more stringent control measures may be indicated (see Daycare section above).

- Students or staff who handle food and have a *S. typhi* infection (symptomatic or not) must not prepare or handle food for others until they have 3 negative stool tests taken 48 hours apart (and no sooner than 48 hours after the cessation of antibiotic therapy). (Per *105 CMR 300.200*)

- Refer to Chapter 8 of the MDPH *Comprehensive School Health Manual* for complete guidelines in handing diseases spread through the intestinal tract.

Community Residential Programs

Actions taken in response to a case of *S. typhi* in community residential programs will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *S. typhi* should be placed on standard (including enteric) precautions until symptoms subside *and* they test negative with 3 consecutive stool samples. (Refer to the Division of Epidemiology and Immunization *Control Guidelines for Long-Term Care Facilities* for further actions. (A copy can be obtained by calling the Division at 617-983-6800 or 888-658-2850.) Close contacts in the long-term care facility, including staff and roommates, should also be tested. If positive, they should be placed on enteric precautions until they test negative with 3 stool cultures. Staff members with typhoid fever infection who give direct patient care (*e.g.,* feed patients, give mouth or denture care, give medications) are considered foodhandlers and must be excluded until producing 3 negative stool specimens (Per *105 CMR 300.200*).

In residential facilities for the developmentally disabled, staff and clients with *S. typhi* must refrain from handling or preparing food for other residents until their symptoms have subsided and 3 stool specimens test negative (taken 48 hours apart and no sooner than 48 hours after the cessation of antibiotic therapy). (Per *105 CMR 300.200*) Other close contacts in the facility should be tested as well, and if positive, subject to the same restrictions stated above.

Reported Incidence Is Higher than Usual/Outbreak Suspected
If one or more cases of *S. typhi* is reported in your city/town among people who have not traveled out of the United States, investigate the case or cases to determine source of infection and mode of transmission. A common vehicle (such as water, food or association with a daycare center) should be determined and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal hygiene and sanitary disposal of feces. Consult with the epidemiologist on-call at the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases across several town lines and therefore be difficult to identify at a local level.

Note: Refer to the MDPH *Foodborne Illness Investigation and Control Reference Manual* for comprehensive information on investigating foodborne illness complaints and outbreaks. (Copies of this manual were distributed to local boards of health in 1997–98. It can also be located on the MDPH website in PDF format at <http://www.magnet.state.ma.us/dph/fpp/refman.htm>.) For recent changes (fall of 2000) to the Massachusetts Food Code, contact the Division of Food and Drugs, Food Protection Program at (617) 983-6712 or through the MDPH website at <http://www.state.ma.us/dph/fpp/>.

D. Preventive Measures

Environmental Measures
Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with the Division of Food and Drugs (DFD) or the Division of Epidemiology and Immunization. DFD can help coordinate pickup and testing of food samples. If a commercial product is suspected, DFD will follow-up with relevant outside agencies. *Note:* The role of the DFD is to provide policy and technical assistance with the environmental investigation such as interpreting the Massachusetts Food Code, conducting a HACCP risk assessment, initiating enforcement actions and collecting food samples.

The general policy of the SLI is only to test food samples implicated in suspected outbreaks, not single cases (except when botulism is suspected). The LBOH may suggest that the holders of food implicated in single case incidents locate a private laboratory that will test food or store the food in their freezer in case additional reports are received. However, a single, confirmed case with leftover food consumed within the incubation period may be considered for testing.

Note: Refer to the MDPH *Foodborne Illness Investigation and Control Reference Manual* for comprehensive information on investigating foodborne illness complaints and outbreaks.

Personal Preventive Measures/Education
To avoid exposure recommend that individuals:
- Wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet and after changing diapers.
- Dispose of feces in a sanitary manner, especially in a daycare setting.
- Scrub their hands thoroughly with plenty of soap/water after assisting in the following: caring for someone with diarrhea, cleaning toilets, or changing soiled diapers, clothing or bed linens.
- Avoid sexual practices that may permit oral contact with feces or urine. Latex barrier protection should be emphasized as a way to prevent the spread of typhoid fever to sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.

International Travel
Persons travelling to typhoid endemic areas should consider vaccination against typhoid fever. They should check with their healthcare provider or a travel clinic for vaccine options. This needs to be done in advance so that the vaccine has time to take effect. Typhoid vaccines lose effectiveness after several years; people vaccinated in the past should check with their doctor to see if they need a booster. Typhoid vaccine is not 100% effective; therefore, travelers must exercise caution when consuming local foods and beverages (which will also protect travelers from other illnesses including travelers' diarrhea, cholera, dysentery and hepatitis A).

Recommend the following to travelers:

- "Boil it, cook it, peel it, or forget it." Avoid foods and beverages from street vendors.
- Drink only bottled or boiled water, keeping in mind that bottled carbonated water is safer than uncarbonated water.
- Ask for drinks without ice unless the ice is made from bottled or boiled water.
- Avoid popsicles and flavored ices that may have been made with contaminated water.
- Eat foods that have been thoroughly cooked and are still hot and steaming.
- Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to thoroughly wash.

Note: For more information regarding international travel and the typhoid fever vaccine, contact the Center for Disease Control and Prevention (CDC), Traveler's Health Office at (877) 394-8747 or through the internet at <http://www.cdc.gov/travel>.

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for typhoid fever. It is provided for your information only and should not affect the investigation or reporting of a case that fulfills the criteria in Section 2) A of this chapter. (CDC case definitions are used by the MDPH and CDC to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2) A.

Clinical description
An illness caused by *Salmonella typhi* that is often characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and non-productive cough. However, many mild and atypical infections occur.

Laboratory criteria for diagnosis

- Isolation of *S. typhi* from blood, stool, or other clinical specimen.

Case classification
Probable: a clinically compatible case that is epidemiologically linked to a confirmed case in an outbreak.
Confirmed: a clinically compatible case that is laboratory-confirmed.

Comment
Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Carriage without appropriate symptoms would not be considered typhoid fever.

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